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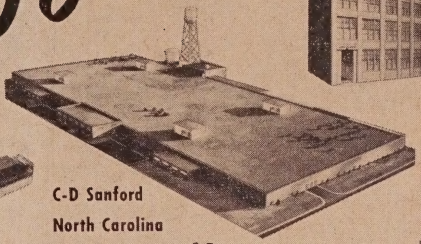

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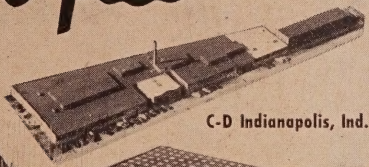

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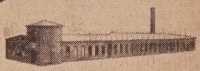

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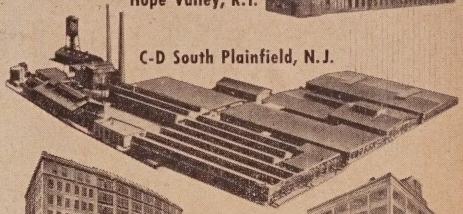

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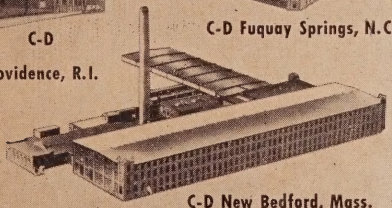

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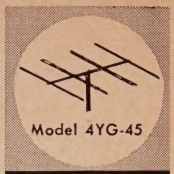
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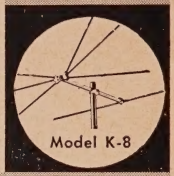
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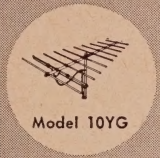
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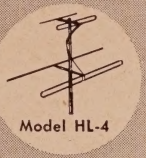
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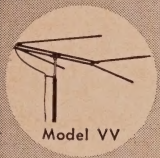
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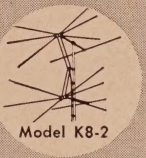
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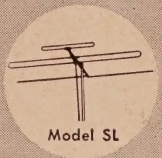
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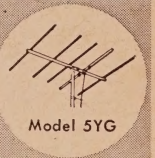
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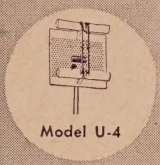
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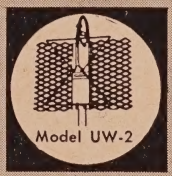
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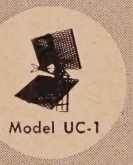
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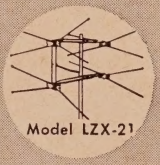
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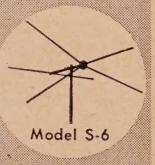
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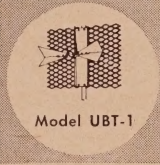
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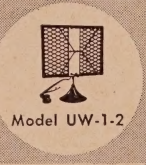
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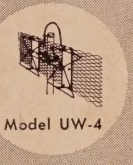
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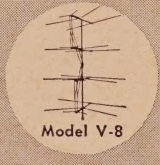
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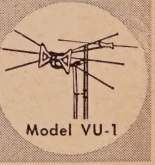
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COMBINATION INDUCTANCE BRIDGE

Until quite recently, many service technicians were inclined to regard the inductance of a coil as something of academic interest only. R-F and i-f coils and r-f chokes seldom needed to be checked, nor did filter chokes which seemed to be workable by brute estimate and demanded attention only when damage was obvious.

With component values more critical today in the TV and electronic equipment the enterprising technician handles, more workers need to make inductance measurements, and the lack of test equipment becomes evident.

A small inductance bridge is a necessary adjunct to present-day shop equipment, since few shops can justify an expensive impedance bridge. Such an instrument will augment the resistance - capacitance bridge already owned by many technicians. This article describes the theory and construction of a simple inductance bridge which is inexpensive and will require only a few hours of a technician's time for assembly. It can be calibrated with a good ohmmeter.

This bridge, which is shown in Figures 1, 2, 3, and 7, covers inductance values from 100 microhenries to 1000 henries in seven continuously variable ranges: 100 uh to 1 mh; 1 to 10 mh; 10 to 100 mh; 100 mh to 1 hy; 1 to 10 hy; 10 to 100 hy; and 100 to 1000 hy. It is completely self-contained.

Bridge Theory

Roughly, there are two types of inductance bridges; those which com-

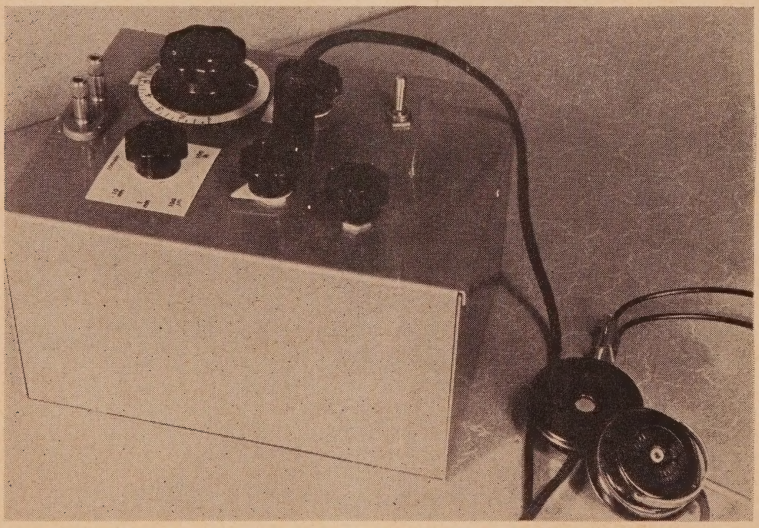

Fig. 1. External View of the Inductance Bridge. Here, the instrument is connected to headphones and is ready for operation.

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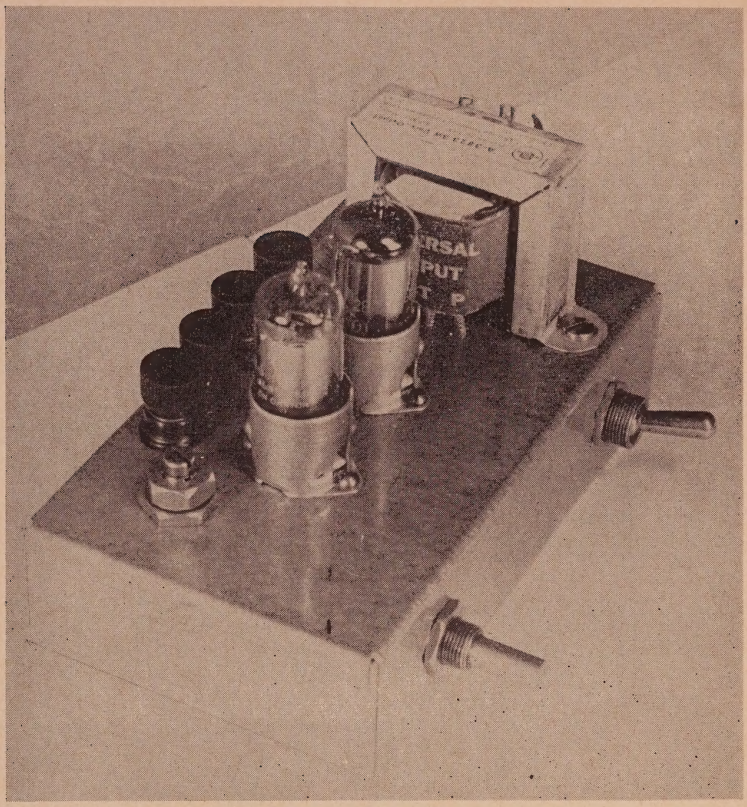

Fig. 2. The Generator Removed From the Bridge. Battery connections are made to the binding posts along the rear edge of the chassis. The unit is held to the front panel of the bridge by the control and switch mounted through the front lip of the chassis.

pare the unknown inductance with a standard inductor, and those that compare the unknown inductance with a standard capacitor. The latter type is the least expensive and the more easily built, since capacitor standards are in general more readily obtained than are standard inductors. Furthermore, if a number of inductance ranges is to be provided, several expensive, and often heavy, standard inductors must be switched into the first type of bridge circuit. Another disadvantage of the inductor-type bridge is the tendency of the standard inductor to pick up hum interference which decreases accuracy of the null adjustment.

Figures 4 and 5 show popular inductance bridge circuits in which the standard is a capacitor. In each of these circuits, L_x is the inductance under measurement and R_x is the resistance component (losses) associated with that inductor. Resistor R_1 is the bridge ratio arm, R_2 the inductance balance rheostat, and C the standard

capacitor. Adjustment of the second variable resistor, R_3, balances the bridge separately for the resistance component R_x of the coil under test. When the circuit is balanced for inductance by means of R_2, and for resistance by means of R_3, completeness of null then usually depends only upon harmonic content of the signal voltage.

The first circuit, Figure 4, is the Maxwell bridge, employed chiefly to check inductors having Q values under

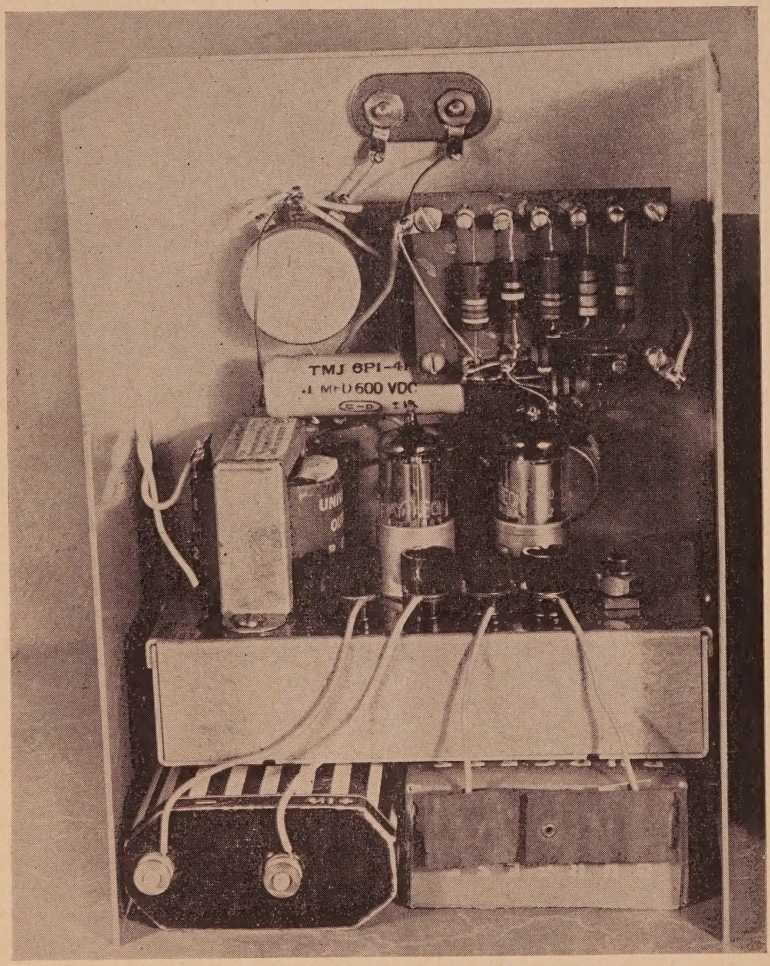

Fig. 3. Inside View of the Bridge.

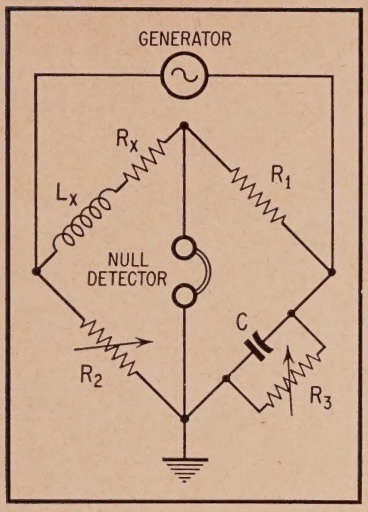

Fig. 4. Maxwell Bridge.

10. When this circuit is balanced:

(1) $L_x = R_1R_2C$

where L_x is in henries, R_1 and R_2 in ohms, and C in farads.

And

(2) $R_x = R_1(R_2/R_3)$

where all R values are in ohms.

While the Maxwell bridge theoretically may be used to check inductors with any value of Q, to do so when this storage factor (Q, X/R) is large, necessitates a high resistance at R_3 not ordinarily obtainable in accurate rheostats.

A complementary type of bridge circuit, used principally at Q values higher than 10, is the Hay bridge shown in Figure 5. It will be noticed that the resistance-balance rheostat, R_3, has been shifted in series with the standard capacitor, C, in this circuit. The losses, R_x, may be shown as a resistor in parallel with L_x, as in Figure 5, or in series as in Figure

4. At null:

(3) $$L_x = \frac{R_1R_2C}{1 + (R_3wC)^2}$$

where all R's are in ohms, and C in farads. $w = 6.28$ f, where f is the bridge generator frequency in cps.

And

(4) $$R_x = \frac{R_1R_2C(wC)^2}{1 + (R_3wC)^2}$$

Note that a frequency term, w, appears in the denominator of the expression for inductance, Equation (3). The standard capacitance (C) and the value of the balancing resistance (R_3) also appear in the denominator. The entire expression $(R_3wC)^2$ can be neglected, however, when the Q of the inductor L_x is higher than 10, without introducing an error of more than 1 percent. This makes the expression for inductance the same as that given in Equation (1) for the Maxwell bridge, and allows the same dial used for the inductance-balance rheostat, R_2, to be read for either the Maxwell or Hay configu-

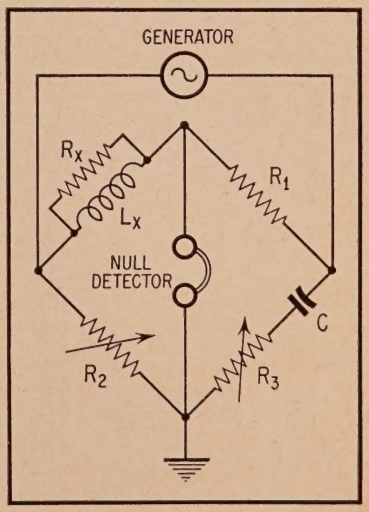

Fig. 5. Hay Bridge.

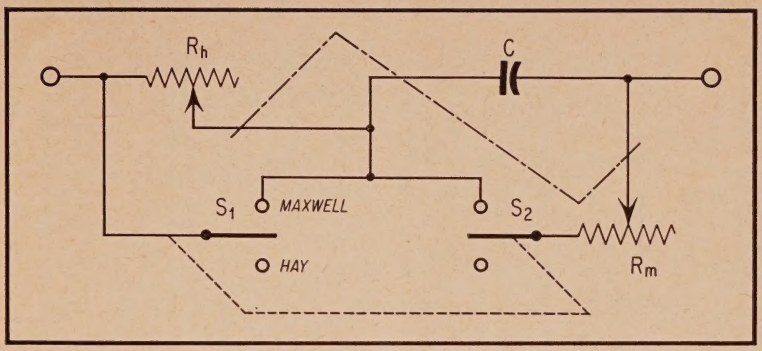

Fig. 6. Switching Circuit for R_3 and C.

ration unless the utmost accuracy is required.

The Hay circuit is particularly useful for the measurement of incremental inductance, since the blocking action of capacitor C in this circuit permits the passage of a polarizing direct current through the coil without passing through and possibly damaging the other bridge arms and null detector, provided the null detector also is capacitance - coupled. This blocking action is lost in the Maxwell circuit where the shunt resistor, R_3, prevents the normal blocking action of the capacitor.

A lower resistance range is required in the series - connected resistance-balance rheostat, R_3, in the Hay bridge than in the complementary parallel-connected R_3 component in the Maxwell bridge. In each bridge, either one or a number of capacitors, C, may be employed. Resistance R_1 is switched, sometimes simultaneously with C, to various values to change the inductance ranges provided by the instrument. The inductance - balance rheostat, R_2, has the same resistance range in both circuits.

From the foregoing theoretical observations, it follows that a convenient general - purpose inductance bridge would combine the features of both Maxwell and Hay circuits. Conversion from one bridge circuit to the other would involve only the switching of a low-resistance R_3 rheostat in series with C or a high-resistance R_3 rheostat in parallel with C. In the Hay connection, the parallel rheostat must be removed and in the Maxwell circuit, the series rheostat must be short-circuited.

Figure 6 shows a simple circuit for accomplishing the changeover from Maxwell to Hay bridge arrangements. This circuit replaces the entire lower right-hand arm of the bridge in the circuits of Figures 4 and 5. In this arrangement, R_h is the low-resistance rheostat for the Hay bridge, and R_m is the high-resistance rheostat for the Maxwell bridge, The changeover is accomplished by means of the dpst switch, S_1-S_2. When this switch is in its upper (closed) position, section S_1 short-circuits rheostat R_h while section S_2 connects R_m in parallel with C. In the lower (open) position of the switch, section S_1 is open and allows R_h to operate in series with C, while S_2 (also open) disconnects R_m from across C.

The procedure in converting the two circuits into a single combination bridge then consists simply of providing two separate resistance-balance rheostats (R_h and R_m), a dpst change-

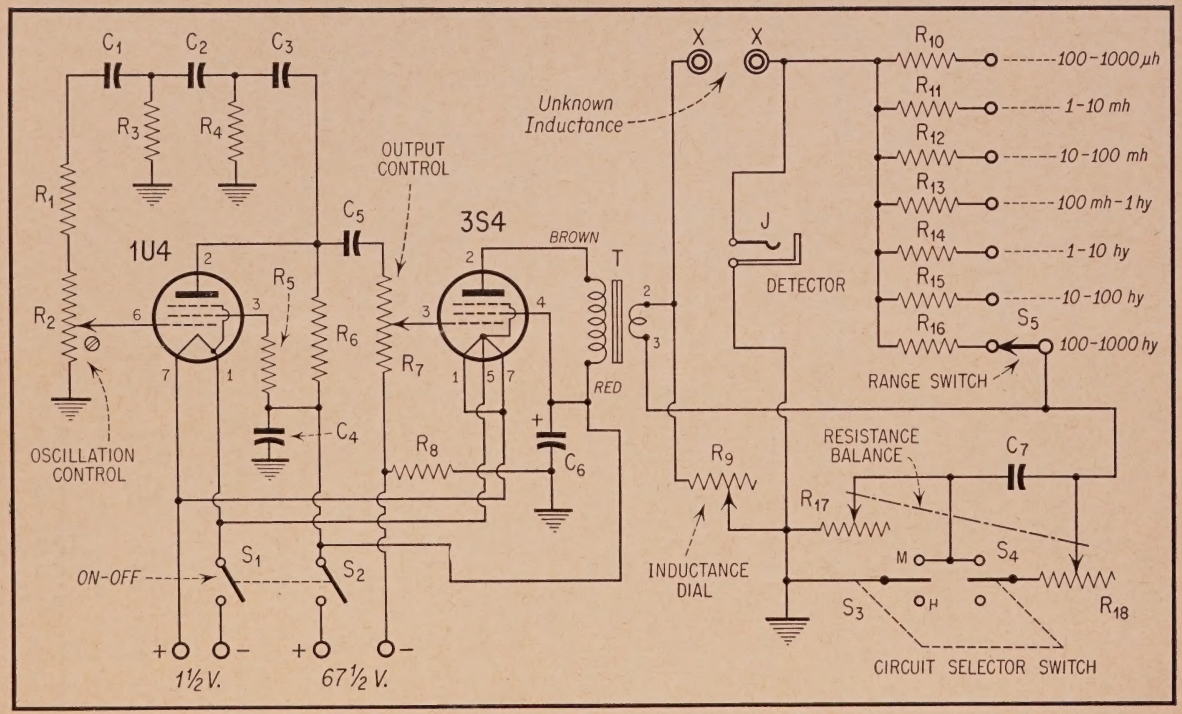

Fig. 7. Complete Circuit of Combination Inductance Bridge.

PARTS LIST (Circuit Fig. 7)

C_1, C_2, C_3—0.005 ufd mica (C-D Super Micadon 1A5D5)

C_4—0.05 ufd 200 volt metalized paper tubular (C-D MTM 2S5)

C_5—0.1 ufd 200 volt metalized paper tubular (C-D MTM 2P1)

C_6—8 ufd 150 volt midget tubular electrolytic (C-D BR 815)

C_7—Selected 0.1 ufd oil-filled tubular (See Text) (C-D TMJ 6P1-4P)

J—Miniature open-circuit phone jack

R_1—8400 ohms ½ watt carbon (See Text)

R_2—10,000 - ohm wirewound potentiometer

R_3, R_4—18,400 ohms ½ watt carbon (See Text)

R_5—68,000 ohms ½ watt carbon

R_6—0.22 megohm ½ watt carbon

R_7—½ megohm potentiometer, audio taper

R_8—470 ohms ½ watt carbon

R_9—10,000 - ohm wirewound potentiometer, linear taper

R_{10}—1 ohm 1 watt carbon (See Text)

R_{11}—10 ohms 1 watt carbon (See Text)

R_{12}—100 ohms 1 watt carbon (See Text)

R_{13}—1000 ohms 1 watt carbon (See Text)

R_{14}—10,000 ohms 1 watt carbon (See Text)

R_{15}—100,000 ohms 1 watt carbon (See Text)

R_{16}—1 megohm 1 watt carbon (See Text)

R_{17}—500 - ohm potentiometer (See Text) (I. R. C. PQ-11-103)

R_{18}—25,000-ohm potentiometer (See Text) ganged with R_{17} (I. R. C. 30 M 577)

S_1-S_2—Dpst toggle switch

S_3-S_4—Dpst, single-gang, non-shorting switch (Mallory 3222J)

S_5—1 - pole, 7 - position, non-shorting rotary selector switch (11-position model stopped down to 7 positions) (Centralab PA-31)

T—Universal plate-to-voice coil output transformer (Stancor A-3823)

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over swich (S_1-S_2), and replacing the entire standard arm of the conventional bridge with the circuit given in Figure 6. For simplicity, R_h and R_m may be ganged for operation by the same dial which can be provided with two scales. The complete bridge described in this article employs such an arrangement.

Details of Circuitry

The complete circuit of the combination bridge is given in Figure 7. The bridge proper occupies the right half of the diagram, and the 1000-cycle generator the left half.

Bridge Circuit. The four arms of the bridge consist of (1) the unknown inductor connected to terminals X-X, (2) a ratio resistor (R_{10} to R_{16}) selected by inductance-range switch S_5, (3) the inductance-balance rheostat (main bridge control), R_9, and (4) the Maxwell-Hay standard arm (C_7-R_{17}-R_{18}-S_3-S_4) similar to the subcircuit shown in Figure 6.

The main rheostat, R_9, is a linear 10,000-ohm wirewound unit of the commercial volume control type. Since this type of rheostat cannot be read accurately below 1000 ohms nor set reliably below that value, it is assumed to furnish a resistance range only of 1000 to 10,000 ohms.

The standard capacitor, C_7, is a 0.1-ufd oil-filled tubular (Corneil-Dubilier Type TMJ 6P1-4P). This capacitor must be selected for 0.1 ufd plus-or-minus 1 percent. Such selected capacitors are available on special order through C-D jobbers. It is possible also to follow the custom of building up a 0.1-ufd capacitor by parallel-connecting ten 0.01-ufd mica capacitors, such as Cornell-Dubilier Type 1A **Super Micadons** also ordered for 1% capacitance rating.

The inductance ranges are obtained by switching the ratio resistors, R_{10} to R_{16} into the circuit. These resistors must be chosen carefully for exact values. Carbon resistors may be employed if they can be obtained within 1% of resistance rating. Otherwise, precision resistors of either the wire-wound or film type must be used.

The lower right-hand arm of the bridge contains the switching circuit allowing choice of either Maxwell or Hay circuit. R_{17} is the 500-ohm resistance-balance rheostat for the Hay bridge, while R_{18} is a 25,000-ohm resistance-balance rheostat for the Maxwell bridge. When changeover switch S_3-S_4 is in its M position, rheostat R_{18} is switched in parallel with standard capacitor C_7, and rheostat R_{17} is short-circuited. Conversely, when S_3-S_4 is in its H position, rheostat R_{17} is connected in series with standard capacitor C_7, and rheostat R_{18} is open-circuited.

Jack J permits bridge-output connections to a suitable null detector. High-impedance headphones will be satisfactory in most instances. For maximum sensitivity and close null adjustment, however, an oscilloscope or a-c vacuum-tube millivoltmeter may be conected to J.

In order to understand how the bridge ranges are obtained, it is necessary to consider that the inductance-balance rheostat is adjustable continuously between 1000 and 10,000 ohms and to refer again to Equation (1). Recall also that the denominator of Equation (3) is assumed to be 1, by neglecting its other term, so that the inductance equation for both Maxwell and Hay circuits is taken as the one shown in (1). When range switch S_5 is set to its topmost position, the 1-ohm resistor, R_{10}, is connected into the circuit. R_9 may have any value between 1000 and 10,000 ohms, and C is 0.1 ufd (1×10^{-7} farad). From Equation (1), the unknown inductance value when null is obtained at the low-resistance setting of R_9 is:

$$(5)\quad L_x = 1(1000)10^{-7} = 0.0001 \text{ hy} = 100 \text{ uh}$$

At the high-resistance setting of R_9:

$$(6)\quad L_x = 1(10{,}000)10^{-7} = 0.001 \text{ hy} = 1 \text{ mh}$$

Thus, the bridge range is 100 uh to 1 mh when S_5 is in its R_{10} position.

For another example, consider S_5 in its fourth position from the top. Here, the 1000-ohm ratio resistor, R_{13}, is connected into the circuit, and the inductance range extends from $L_x = 1000(1000)10^{-7} = 0.1$ hy $= 100$ mh to $L_x = 1000(10{,}000)10^{-7} = 1$ hy. This range thus is 100 mh to 1 hy.

From these data, it is easy to see that the dial, or pointer scale, of rheostat R_9 may be graduated in steps between 1 and 10 corresponding to resistance settings from 1000 to 10,000 ohms, and inductance values read from this dial and the setting of switch S_5.

The resistance-balance rheostats, R_{17} and R_{18}, are ganged together so as to be adjusted by a single dial. Section R_{17} is 500 ohms; section R_{18} 25,000 ohms. Two scales may be provided on the dail of this dual rheostat. One would read the resistance settings of R_{17}, and the other resistance settings of R_{18}. If the value of the resistive component of the inductor under test is desired, the R_{17}-R_{18} dial reading at resistance null can be substituted for R_3 in Equation (2) when switch S_3-S_4 is in its M position, or for R_3 in

Equation (4) when S_3-S_4 is in its H position. The calculated value of R_x then may be used with the bridge-measured value of inductance L_x to determine the coil Q:

(7) $Q = X/R = (6.28fL_x)/R_x$
where f is in cycles per second, L_x in henries, and R_x in ohms.

Where f is 1000 cps, as in the bridge described in this article, this equation simplifies to $Q = (6280L_x)/R_x$.

Generator Circuit. It is advantageous to make bridge inductance measurements at 1000 cps. The signal source must be able to supply enough energy with the bridge in its low-impedance condition (resulting when set up for small inductance values) to enable a useful detector-signal amplitude. This means that the signal source must be a power generator rather than a mere voltage source. Furthermore, the generator must contain such isolation that loading due to varying bridge conditions will not shift its frequency.

These requirements have been satisfied in the oscillator-amplifier arrangement shown on the left-hand side of Figure 7. A 1U4 pentode is employed as a 1000-cycle phase-shift oscillator, and it is followed by a 3S4 power amplifier. The bridge signal then is coupled into the bridge circuit through the low-impedance secondary of the output transformer, T. Filamentary tubes and batteries are used in order to make the bridge entirely self-contained and independent of the power line. The 1½-volt "A" battery drain is 150 ma, and the 57½-volt "B" battery drain 11 ma. These low drain levels result in long battery life. A comparable ac-operated unit would employ a 6AU6 and 6AQ5.

The oscillator frequency is set by the phase-shift network, C_3R_4-C_2R_3-$C_1R_1R_2$. Each of these RC legs provides the 60 degrees of shift at 1000 cps needed for the total 180° shift for oscillation. The resistance values of R_1, R_3, and R_4 must be chosen exactly. Each leg may be made up of separate, series-connected resistors to give a total of the exact specified per-leg resistance. The grid leg, R_1-R_2, is composed of the two sections in series, since the gain control is needed at this point as a feedback adjustment. If it is not included, feedback can become excessive to the point of degrading the waveform. If an individual builder is not interested in obtaining an exact 1000 cycles, he can use the more easily obtained integral values of resistance in the phase-shift legs. For example, an even resistance of 20,000 ohms per leg will, with the same 0.005-ufd capacitors, yield a calculated frequency of 905 cycles.

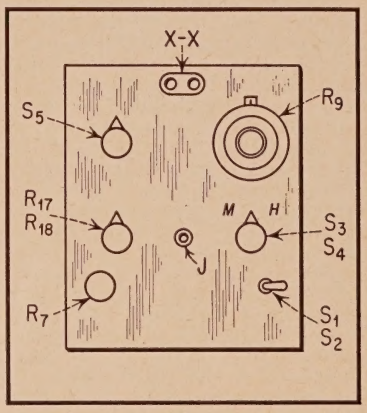

Fig. 8. Front-Panel Layout.

Potentiometer R_2 corrects the signal waveform by controlling the amount of feedback voltage applied to the 1U4 grid. Potentiometer R_7 is used to adjust the amplitude of the output signal applied to the bridge. To develop a useful detector signal amplitude, more generator power output is needed when working into the bridge set up for low inductances(especially in the region 100 uh to 10 mh) than when checking high values.

A readily - obtained plate - to - voice coil transformer is used at T, although

a more advanced, shielded bridge transformer can be employed when the considerably higher price appears justified.

Bridge Construction

Constructional details are shown by Figures 1, 2, 3, and 8. This is a practical layout but is not mandatory.

The instrument is completely self-contained in an aluminum chassis box (LMB No. 146) 8" high, 6 " wide, and 4½" deep. Figure 1 shows the external appearance of the bridge. Figure 8 identifies the controls on the front panel.

Figure 2 shows the 2-tube signal generator which is built into a second aluminum chassis box (LMB No. 139) 5½" long, 3" wide, and 1½" high. This chassis is held to the front panel of the main case by the output-control potentiometer (R_7), seen on the left, and the ON-OFF switch (S_1-S_2) seen on the right. The oscillation-control potentiometer, R_2, may be seen to the left rear of the generator chassis. It is provided with a slotted shaft for screwdriver adjustment and a shaft-lock nut. This control is mounted in this position inside the instrument to protect it from accidental movement, since it seldom needs readjustment once it is set for sine-wave output. Four insulated binding posts for battery connections are mounted along the rear edge of the chassis. Signal output leads are soldered directly to the No. 2 and No. 3 taps of the output transformer.

The various sections of the bridge are seen in the inside view, Figure 3. Note that the range resistors (R_{10} to R_{16}) are mounted on a phenolic plate (upper right-hand corner) back of range switch S_6. The upper binding post assembly (terminals X-X in Figure 7) is a National Type FWH unit. The batteries are seen in the bottom of this photograph. The "A" battery is a flat, Burgess Type 2FBP 1½-volt unit; the "B" battery is a Burgess Type XX45 67½-volt unit. These batteries fit comfortably, but not snugly, under the generator chassis. A strip of insulating tape is cemented to the back of the main case to prevent grounding of the "A" battery terminal screws. The connector clip-assembly for the "B" battery is supplied fiber-insulated and prevents grounding of the 67½-volt battery.

The dual rheostat, R_{17}-R_{18}, must be made up by the builder. The front section is an I. R. C. Type PQ-11-103 500-ohm unit. The rear section, a 25,000-ohm I. R. C. Type 30 M 577 section, is fastened to the front section in the same simple manner that a switch ordinarily is attached to a control. These two sections are obtainable at all radio stores. For precision applications, a dual wire-wound rheostat must be obtained on special order.

The dial plate for the inductance-balance rheostat, R_9, is made of white paper cemented to the metal dial and covered with thin plastic sheet for dust protection, and the lines and figures are drawn with black India ink. The inductance range scale (switch S_5) is made in the same manner. No scale was provided for the dual resistance-balance rheostat (R_{17}-R_{18}) in the instrument shown in the photographs, since the original builder used this adjustment only to perfect the null and did not require readings of the inductor resistance component. A dial can be prepared easily, however, as will be explained under "Adjustment."

Wiring in the generator is entirely within the small chassis box. All bridge wiring should be as direct, short, and rigid as practicable to promote stability. The leads from transformer T to the bridge circuit proper should be twisted together tightly, as seen in Figure 3, to keep their capacitance constant and to allow them to be tucked away easily to one side of the case.

An advantage of the self-contained battery operation is absence of the

large amounts of internal heat produced by ac-operated tubes and power supply. This allows complete, shielded enclosure of the instrument without vent holes or louvers. It also reduces the size and weight of the bridge considerably and avoids the troublesome hum fields that would arise from a power transformer and filter choke. Such fields are of little concern in resistance-capacitance bridges, but are serious in any form of coil checker.

Adjustment

Inductance Dial. Prepare this dial before the bridge wiring is connected to rheostat R_9. Cement a white paper face to the dial, and tighten the dial securely to the rheostat shaft. With the aid of a good ohmmeter or an accurate resistance bridge, connected to the terminals of R_9, make the calibration in this manner: (1) Set R_9 to 1000 ohms and mark this point 1 on the dial. (2) Set to 2000 ohms and mark this point 2 on the dial. (3) Repeat the procedure at each 1000-ohm step up to 10,000 ohms, marking this last point 10 on the dial. (4) Fill-in as many measured intermediate points as possible, for close reading of inductance values.

Resistance Dial. Before wiring is completed to the dual rheostat (R_{17}-R_{18}), prepare its dial in the same manner just described for the inductance dial, except that actual resistance values must be inscribed on this dial. One such resistance scale is made for R_{17} and another for R_{18}. The R_{17} scale can be labelled H (for Hay), and the R_{18} scale M (for Maxwell).

Generator. After the bridge is wired, switch-on the power and connect an oscilloscope to terminals X-X. The bridge controls can be set to any point but no coil should be connected to the X-X terminals. Set control R_7 for maximum output. Set the oscilloscope sweep to display 2 or 3 cycles of the bridge signal on the screen. Adjust control R_2 for the cleanest sine-wave signal. After this adjustment is made, tighten the shaft lock on R_2.

While the oscilloscope is connected, the generator frequency may be checked against an external audio oscillator by using Lissajou's figures. Should it become necessary to adjust the frequency, the best procedure is to alter each phase-shift resistor (R_1-R_2, R_3, and R_4 in Figure 7) by the same amount. However, a small frequency shift is obtainable by adjusting only one of these resistors. A large change in one resistor, however, as well as a large change in all three, might destroy oscillation with a given set of capacitors by extreme reduction of the feedback voltage. When this occurs, the capacitance values also must be altered, changing each by the same amount.

Operation

Connect the coil under test to terminals X-X. Be careful to keep this coil out of any a-c fields. Set switch S_3-S_4 to its M position. Switch-on the power, plug-in the headphones (or other detector; such as oscilloscope, amplifier, or a-c vacuum-tube millivoltmeter), and set R_7 for a readable signal. Set S_5 successively to various ranges, while adjusting R_9 from one end to the other of its range, until a null is detected. This usually will be noticeably broad.

Now, simultaneously adjust R_{17}-R_{18} and R_9 until the null is clean and sharp at a definite spot on the R_9 inductance dial and no longer drifts on this dial. If R_{17}-R_{18} is turned all the way to the end of its range with steady improvement of null, throw switch S_3-S_4 to its H position and repeat adjustments until the null point is within the R_{17}-R_{18} range. At this point, read the unknown inductance value from the R_9 dial and S_5 range settings. Then read the appropriate scale of the R_{17}-R_{18} dial for the resistance value to be used in the calculation of the resistive component and Q of the coil under test.

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FOR SALE — Preamplifier and mike for auto radio, $10 postpaid. Works good. V. Powell, 731 North 2 East, Provo, Utah.

SELL OR TRADE — Weston model 663 VOM; Triplett model 1200G VOM; RCP model 664 VTVOM; vacuum cond. VC-50-32KV; misc. oil condensors. M. Schultz, 450 West 125th Pl., Chicago 28, Ill.

FOR SALE — Davis Supervision antenna, 1. n., $15; Astatic VHF booster, model CT-1, 1. n., $7.50. All prices FOB. J. P. Isaacs, 1300 California Ave., Compton, Calif.

FOR SALE — 16" Traveler model 65C50 console, $50; 10" Philco model 1001, $30; 7" Motorola, $25; Heathkit battery eliminator BE3, 1. n., $20. All in working cond. Harry's TV, 120 - 51 232nd St., Cambria Heights 11, L. I., N. Y.

SWAP — Antique radio equip. (about 1918-1925), for modern test equip. A. R. Bolz, 219 Morris Ave., Lutherville, Ind.

JOB WANTED — Middle-aged man with 25 years' radio service and 5 years' TV servicing experience, sober, reliable, can furnish good references. Will go anywhere. Rob Roy, Jr., Alexandria, Tenn.

FOR SALE — 5 like new 0-1 ma. meters, 4", in square bakelite cases, knife-edge pointer, VOM scale, 50 ohm internal resistance, orig. boxes, $5 each postpaid. L. Cohn, 151 - 09 34th Avenue, Flushing 54, N. Y.

SWAP — Regency converter UHF, model 600, for a 30 to 50 mc FM Civilian Defense set in working cond. — not a repair job. C. G. Davis, Odessa Radio Shop, Odessa, N. Y.

WANTED — Radio News, Jan. to June, Sept., 1950; Jan. and March, 1951; Apr., June, Aug., Oct., 1953. Also CQ's for Jan., Feb., May, June, July, 1945. State cond., and price. H. W. Merideth, 3912 Anderson Ave. SE, Albuquerque, N. M.

FOR SALE — C-D Powercon converter, model 110T22, input 110 v. DC, output 110 v. AC at 225 w., never used, units less vibrators, $30 each, or trade for electronic equip. of equal value. Rudy Bruna, Route 1, Box 36, Libertyville, Ill.

WANTED — Riders manuals, used copies TV and radio, any or all volumes. State price and condition. Messenger Radio Workshop, 81 Mechanic St., Foxboro, Mass.

FOR SALE — Lampkin 105B frequency meter and Lampkin 205 FM deviation meter. Used very little. C. T. Buffington, 18 W. Green St., Westminster, Md.

FOR SALE — Eico TV-FM sweep gen., wired, $23; Eico 5" push-pull scope, wired, $33; Precision E-200C sig. gen., wired, $35; test equip. in perf. cond. Jack Moderno, 313 Stockholm Street, Brooklyn 37, N. Y.

SELL OR SWAP — Back issues of Radio News, Radio Craft, QST, Popular Mechanics and Journal of Franklin Institute; also CR tubes 5BP4 & 5CP1A. Want amateur parts and ARRL or Radio Handbooks. George Daubert, Apt. A, 111 White Horse Pike, Audubon 6, N. J.

WANTED — Jackson scope, model CRO-2 or Precision model ES-500A or equiv.; also Precision E-400 sweep gen., Hickok tube tester, model 533AC or similar. Must be reasonable. R. V. Menzies, 5833 McAndrew Dr., Oakland 11, Calif.

WANTED — Radio instructor in theory and service repair, ham licensed, color TV instructor. Negro. Contact Edward Davis, Jr., Davis Trade School, Inc., Louisville, Ky.

FOR SALE — Meters, tools, tubes, books, caddies, etc. All items for TV servicing in the home. Local sale only. Ralph L. White, 76 Barber St., Springfield 9, Mass.

FOR SALE — KAAR AM phone transmitter, 10 meters, 40 w., instant heating filaments, $25; unused Eimac vacuum variable 20-60 mmfd., 10,000 v. DC, $25; Gonset converter 3-30 mc., $20; Amertran plate transformer, 6200 v. C.T., 700 mils conservative. S. C. Macy, 2346 Dundee, Louisville, Ky.

FOR SALE — Approved model A-400 marker sweep gen., used less than ten hours, in orig. carton. Will ship prepaid for $50. Ardmore Radio-TV Service, 114 Lockland Ave., Winston-Salem, N. C.

FOR SALE — Bogen Challenger 200 two-station Intercom set, less 50 ft. cable, used very little. No offer under $20 acknowledged. William Kemper, Jr., 2403 Fifth St., Peru, Ill.

FOR SALE — Eico 320 sig. gen., $8; Speedex wire stripper kit, $5; old Garrard 78 rpm turntable with governor and regulator, $5, postage paid. R. H. Rogers, 28 Bellamy St., Boston 35, Mass.

WANTED — Hallicrafter model S-38 or S-53. Will pay cash or trade radio parts. State price and cond. Radio Clinic, 845 Allingham, Van Wert, Ohio.

WANTED — Portable battery radio and camera combination, built a few years ago. Send picture of same, information and price. Z. T. Bogar, Burtonsville, Md.

SELL OR SWAP — Alliance-Tenna rotor, misc. radio parts and publications. Can use tape recorder. H. O. Weiger, 105 West Chicago Ave., Maywood, Ill.

FOR SALE — 600 radio and TV tubes. Will sell for best offer. Complete list mailed if interested. Robert E. Wild, 499½ Main St., East Orange, N. J.

SELL OR SWAP — Clavioline (electronic musical instrument similar to Solovox); and an amplified accordion, complete, reasonable. Jay Stemmerman, 8932 88th St., Woodhaven 21, N. Y.

FOR SALE — All like new. RCA MI-12002 velocity broadcast mike; G.I. RC130L two speed 12" disc recorder-record changer; GE phono pre-amp.; Custom pre-amp and tone equalizer with power supply; Heath TS-1 sweep gen. Best offer. John Thiel, 1003 North Denver, Tulsa, Okla.

SWAP — Two-tube Radiola III battery rcvr. for one-tube Crosley model V rcvr., or good copy of J. H. Morecroft, "Principles of Radio Communication." Myron B. Reynolds, 70 Swaggertown Rd., Scotia 2, N. Y.

FOR SALE — Riders radio manuals 3 to 10 in perf. cond., used very little, $40; G.I. recorder with crystal playback and magnetic cutting head in portable case, $30. Al Crispo, 85 - 02 133rd Ave., Ozone Park, N. Y.

SWAP — 82 copies of Service, '46 to '53; 66 copies of Service Dealer, '49 to '53; 3AP1 CRT. Need sweep generator. Alex Atkinson, 18231 Winthrop, Detroit 35, Mich.

FOR SALE — Unused ART 13 speech amp., with tubes, $15; auto-transformer 600 VA $6; 75 M mobile converter, $10; mobile equip., cheap. A. Brocato, 699 Idlewild Circle, Birmingham, Ala.

FOR SALE — Riders manuals vols. 1-10. $100 takes all, you pay postage. Robert M. Stellmaker, Hinckley Hill, Westerly, R. I.

SELL — Like new Western Electric tubes: 102D, two 313C, seven 215A; three sockets for 215A. $10 for lot. Riddell, 6105 North Glenwood, Chicago 40, Ill.

SELL OR SWAP — Heath 0-9 scope; Heath V-5 VTVM; Precise 630 audio and RF generator; QST's 1927 thru 1948; Hallicrafter S-20R. Want HQ 120 or 129X; Viking Ranger I, II. Bob Schill, 1400 Poulson, Wantagh, N. Y.

FOR SALE — Lysco 10 M. mobile-Xmtr., XE10 (30-40 mc. police receiver mobile) 1750 v. supply, tubes: 814, 829B, ZB120, 2E24, 35T. Want 304TL, 5 v. 30 amp. fil-xmfrs., modulation transformer 1 kw. D. Howerdel, 223 Terrace Ave., Jersey City, N. J.

FOR SALE — Rola 12" and 14" speakers, woofer and tweeter combination with output xformer, cross-over, mounted on baffle board, dynamic, $10, amplifier and power supply for same, 15 w., $9. Both for $17.50. J. Block, 1207 President St., Brooklyn 25, N. Y.

FOR SALE — Measurements sig. gen., model 78B, 85-160 mc., 125-240 mc., $75. Edward Kob, 9554 West Belmont Ave., Franklin Park, Ill.

WANTED — Pilot model AA903 10 w. amplifier, and University model 6201 or equiv. 12" coaxial speaker. Units must be in perf. operating cond.. State lowest delivered price. D. Kurs, 321 Fairmount Ave., Jersey City, N. J.

FOR SALE — Sprague Tel-Ohmike model TO-4, with instructions, $59; NRI sig. gen., model 88, with instructions, $35; Superior Junior Super meter, with instructions and schematic, $12. All 1. n. George J. Schalk, Jr., 1973 Fulton St., Brooklyn 33, N. Y.

SELL OR TRADE — Pair Army sound power phones, $25; Alliance TV booster, $10; Granco UHF converter, $15; DeWald 3-way port. model D-509A BC-SW, $49. Paul Mollenhauer, 1518 W. Madison St., Chicago 7, Ill.

WANT — BC-191 in unaltered condition, no damaged parts, transmitter only. L. C. Chapman, Fairhope, Ala.

FOR SALE — VHF Hallicrafters model S-36 communications rcvr., continuous tuning 27.8 to 143 mc. AM-FM, good cond. with technical manual included, $100. Joseph S. Mackora, 328 Saybrooke St., Hartford, Conn.

SELL OR TRADE — Complete course on color TV by RCA; Hickok model 900B volt, amp., watt meter, test leads, and carrying case. Both items complete and in exc. cond. Want scope, gen., 16 mm. camera or what? William Barber, 309 Alexander St., Youngstown, Ohio.

FOR SALE — G.E. model 260 storage battery, all-wave portable radio, 1. n. cond., including service sheets, extra power unit, charging cord, tubes, extra small parts, $50. Prefer local buyer. Adolph Kisling, 51 Reservoir Pl., Belleville 9, N. J.

SELL OR SWAP — 3 General Radio multivibrators, 10-50-100 kc., $150; Heath grid dipper, low freq. coils, $20; Heath sig. gen., $20; UTC 250 w. mod. Xfmr., driver Xfmr., $18. T. H. Stahl, 2134 Hawthorne Rd., Grosse Pointe Woods 36, Mich.

TRADE — 10 meter Gonset converter for BC-454 3-6 mc. command receiver. Louis E. Brown, 2115 Melbourne, Dallas 24, Texas.

FOR SALE — Converting to Binaural Tape! Sonar reversible half track recorder, over 10 kc. at 7½", 10 w. UTC output, was $375, make offer; binaural records $3.95, grade A plastic recorded tapes, $2.70. H. H. Heller, 2121 Renrock Rd., Cleveland 18, Ohio.

FOR SALE — Wilcox-Gay tape and record cutter, M3C10, $100; Riders TV manuals 4 to 12, $100. R. Van, 412 Humboldt St., Rochester, 10, N. Y.

FOR SALE — 2-sided 2-color neon sign, TV - Radio, approx. 30" x 36", overhanging type with mount and guy brackets, $100 prepaid. Going out of business. W. H. Hervin, 1955 Orchard Lane, White Bear Lake 10, Minn.

TRADE — Printing for test equip., business cards, value $4.95 to $6.50; stickers, envelopes and letterheads. John J. Trowbridge, 312 West 75th St., Chicago 21, Ill.

SELL — Eico battery eliminator, $20; R23/ARC-5 receiver with dynamotor, unmodified, $20; PE101C modified mechanically, $4; BC-696 coil set, $2.50. All plus postage. Need late model rcvr. M. J. Marshall, 455 Washington Ave., Dumont, N. J.

WANTED — Gonset 10 meter converter in operating condition. V. E. Freist, 1317 Summit Ave., Union City, N. J.

TRADE — 400 Westinghouse 6J6's, all 1. n. Need mobile converter, tubes and small parts for radio and TV service, good typewriter. J. Snow, Box 376, Eldorado, Okla.

FOR SALE — Trio Phaseitron TV antenna and control for channels 4 and 5, complete, $25. Mark W. Ewald, 417 East State St., Rockford, Ill.

SELL OR TRADE — Victor 16 mm sound projector in good operating cond., 1,000 w. lamp and 25 w. amplifier, speaker and cases. Carl Stahnke, 8401 NW 14th Ave., Miami 47, Fla.

WANTED — For cash, 150 mc. transmitter and receiver, 50 w. max., fixed freq., prefer 110 v. AC operation but 6 v. DC is OK. Must have schematics. Herb Evans, 1410 NE 2nd Ave., Miami 36, Fla.

WANTED TO BUY — 1924, '25, or '26 Operadio portable in working cond., with lid-aerial and good case. W. B. Blood, 330 West 42nd St., New York 36, N. Y.

FOR SALE — KW transmitter; TCS transmitter, 20 M beam, tubes, etc. E. L. Felder, Tylertown, Miss.

FOR SALE OR TRADE — Part-time radio business. Send for inventory (under wholesale). Will trade for one or more antique cars, under 1913. Harold Garrett, 711 South New York, Sedalia, Mo.

FOR SALE — Q5'er modified for 1400-1600 kc convertor input, cystal controlled, complete with all data, tubes and 6 v. dynamotor. T. G. Moline, 623 North 5th St., St. Peter, Minn.

SELL OR TRADE — Local only; S-40A rcvr. with S-meter SM40; Elincor model 400EA 3-element 10 M. beam, with Alliance Tenna-Rotor model D1R plus cash or gear, for NC-125 or HQ-129. Joseph Lucca, 221-37 113th Dr., Queens Village 29, N. Y.

WANTED — Copy of Operation and Maintenance Manual for SCR 274-N radio equip., or its ARC equivalent. Royce Heintz, 3500 Woodmoor Road, Baltimore 7, Md.

SELL OR TRADE — 250 popular radio tubes, name brands; numerous by-pass and filter condensers. Want rotating Standard Wattmeter, clamp-on power factor meter, or cash. G. Armbruster, 1425 North Nicholas, Appleton, Wis.

WANTED — RCA 204T1 horizontal output transformers, any quantity. State cond., and price. Will pay cash or trade Jackson model 420 sig. gen., Weston Volt-Ohmeter, battery eliminator, radio and TV tubes. Sidney S. Goodkin, 231 East Jackson St., Ottawa, Ohio.

SELL OR TRADE — BC-274-N Command set; 2 transmitters with rack, 5.3-7 and 4-5.3 mc.; 3 receivers with rack, 3-6, 6-9.1 mc., and 190-550 kc., all exc. cond., with dynamotors and modulator, $50. Buddy's Radio Service, Smiths Ferry, Pa.

FOR SALE — National HFS receiver with all coils, 110-220 v. AC matching power supply, and instruction manual, $75, FOB. Need Monitoradio M-51 receiver. S. Briggs, 3700 Wentwood Dr., Dallas, Texas.

FOR SALE — BC-654A transmitter-rcvr. from SCR-284-A, complete with PE-103A, T.M.-11-275, all cables, T-17 mike, key J-48, like new, $75, express collect. A. H. Hawkes, 10 Hardy Rd., Westbrook, Maine.

WANTED — SX-28A receiver in good cond., prefer near New York City. State price . Wm. Maron, 815 Kinderkamack Rd., River Edge, N. J.

FOR SALE — BC-223 AC transmitter; Eldico TR-75-TV2 Xmitter; back issues of Radio & Electronics, Radio-Television News, Popular Mechanics, Popular Science, Science & Mechanics. James Dilworth, 5 Washington Pkwy., Bayonne, N. J.

SWAP — Simpson model 390 volt-amp-wattmeter; Eico model 145 sig. tracer; Wagner $\frac{1}{4}$ hp capacitor start motor, like new. Want SX-28A rcvr.; VHF 152A converter; BC-221. George Hague, 6 Carver St., Fall River, Mass.

FOR SALE — National NC-98 rcvr., with instructions, in orig. carton, used only few hours, $125. Will pay shipping. Harold E. Moats, 44 Oak St., Chagrin Falls, Ohio.

POSITION WANTED — In Radio-TV shop. Recent NRI graduate, good references and some experience. Geo. W. Deans, 805 Bay St., Morehead City, N. C.

FOR SALE — RA34(H) $40; VHF 152A $50; modulator, 40 w., $45; HY-Q 75 oscillator with tube and instr., $5; TA12-B with tubes, needs work, $7.50. Dick Thorpe, 303 South Louise Ave., Azusa, Calif.

FOR SALE — Hallicrafter SX-71 receiver, used very little, perf. cond., with spare tubes. Prefer local. Richard Ebeling, 33 Randolph Rd., White Plains, N. Y.

FOR SALE — Eico tube tester, like new, complete with picture tube test adapter, $30. Roy A. Throckmorton, 268½ Carroll St., Akron 4, Ohio.

WANTED — Government technical manuals on radar, radio, Loran, teletype, etc.; also ART-13, ARN-7, ARC-1, TS test equip. Arrow Appliance Co., 38 Exchange St., Lynn, Mass.

SELL — HQ-120-X receiver, $65, or trade for test equipment. Charles E. Neer, Williamston, N. C.

TRADE — Eico 950 condenser checker, 360 sweep, 425 scope; Heathkit VTVM with high voltage probe, Bar gen., Supreme 502, Jackson 103, Precision 612 tube testers. Trade for other instruments. C. Albertoni, 2629 Paxton, Akron 12, Ohio.

FOR SALE — Pilotuner T-601 unused, in original carton, $20 prepaid. Ardmore Radio-TV Service, 114 Lockland Avenue, Winston-Salem, N. C.

POSITION WANTED — As Radio-TV repairman, 15 years' experience in own shop, repairing all makes, age 42. Can furnish all equip., also hold FCC ticket. Warren J. Currence, 200 Diamond St., Elkins, W. Va.

SELL OR TRADE — Eico model 221 VTVM; EMC model 106 VTVM; SG-7 Heathkit sig. gen.; E-200-C Precision sig. gen., electronic components and magazines. O. Zethmeier, 1123 Woodycrest Ave., New York 52, N. Y.

FOR SALE — 6 w., 40-meter fone Xmtr., crystal control, $10; 40-meter CW, 140 w., input Xmitter, VFO, power supply, no TVI, $45; BC-459 with power supply, low-pass filter, $35. Frank A. Walker, 10015 Yale Ave., Chicago 28, Ill.

FOR SALE — Books: Radio Engineering, Terman; Communications Engineering, Everitt; Principles of TV Engineering, Fink; Fundamentals of Vacuum Tubes, Eastman; Radio Engineering Handbook, Henney; High Frequency Measurements, Hund, 8 RCA service manuals, and 12 booklets, $20 FOB. M. Wendroff, 1745 East 16th St., Brooklyn 29, N. Y.

FOR SALE — 1947 Emerson, Standard broadcast AC-DC radio receiver, model 541, in good playing cond., $10 plus postage. Samuel T. Chase, 20 Brookside Ave., Somerville, N. J.

FOR SALE — Gardiner tape sender with 12 rolls tape and 110 v. AC audio oscillator, $21 postpaid. Fred R. Herr, 911 Old Manoa Rd., Havertown, Pa.

FOR SALE — BC-654A Xmitter-rcvr.; BC-455B rcvr., 6-9.1 mc; sig. gen.; RCA model 705A, and several rcvr. power supplies, 250 v., 6.3 v. Best offer individually or for lot. A. Tedeschi, Yantic, Conn.

FOR SALE — Established radio-television store retired. Entire stock: tubes, condensers, transformers, asst. hardware, etc. Cheap. A. J. Careccia, 2235 Bassford Ave., Bronx 57, N. Y.

WANTED — 5-25 henry 500 mil choke (swinging); 20 henry 500 mil choke (smoothing); 250 w. Varimatch Modulation Xformer. Frank W. Jones, Gabbs, Nev.

SELL OR TRADE — Two Sylvania UHF converters; two FM converters; GE volt-ohmmeter, in metal case; model 315 Simpson sig. gen. Want used ham rcvrs. D. L. Smith, Smith's Radio Shop, Box 191, Leaksville, N. C.

SELL OR TRADE — '49 Mercury Deluxe push button radio, one Crown heavy duty rotor with indicator and control cable for amateur beams. Want good comm. rcvr., radio. W. E. Snell, Box 836, Thomasville, Ga.

FOR SALE — Globe Scout model 40A, 160 thru 10, pi-net output, 6146 final, fine cond., $65 plus shipping. Margaret Cauffield, Route 1, New Florence, Pa.

FOR SALE — Sixty bobbins of mixed values, "Driver-Harris Co." Nichrome manganin and advanced alloy resistance wire. Rodney F. Stubbing, 800 North Harrison St., Wilmington, Del.

WANT — Q meter, grid dip osc., AM-FM sig. gen., audio osc., S.W.R. bridge 22, in trade for misc. transmitting tubes; WE-600A mike. T. W. Hopkinson, Box 921, Charlottesville, Va.

WANTED — 1 KW RCA modulation transformer. State lowest price. Dave Howerdel, 223 Terrace Ave., Jersey City, N. J.

SELL OR SWAP — Electric Instrograph, 10 tapes, little used, A-1 cond., $40, for cash or test equip., wired or kit form. State model. P. Stachiw, 4734 Willys Parkway, Toledo 12, Ohio.

SELL OR SWAP — Reconditioned General radio, Leeds & Northrup, W.E. decade resistance boxes, decade condensor boxes, attenuators, variable air capacitors. Alex Uminski, 1948 Farmingdale Rd., Westfield, N. J.

SELL OR TRADE — Buescher alto sax, silver finish with gold bell, carrying case, like new, for Viking Ii or Collins 32V2. George Teufel, 622 Hubbard Ave., Union, N. J.

FOR SALE — Altec Lansing 604B and network, $115; Altec Lansing A-323B amplifier, $50; Partridge CFB output transformer, 10K ohm, $30; Klipsch bass folded horn with 15" driver and 400 cps network 8 ohm, $100. A. J. Avis, 12560 Knoll Dr., Los Altos, Calif.

FOR SALE — Old radio books and magazines, will trade for typewriter or what have you? Clifton Shears, Cresaptown, Md.

SELL OR SWAP — Like new "Match Box" $39.50; 160-80-40 m. Command transf., dual rack with MD-7 modulator. Want Heathkit VFO, BC-946 rcvr., Balun coils. D. L. Hansen, Box 273, Coleraine, Minn.

FOR SALE — Telephone pickup microphone, records both sides of phone conversation, no connections to phone, $3.50 delivered; meter rectifiers, 1 ma. or 5 ma., $.50 each. Want telephone equip. Charles Sass, 1445 8th Ave., Sacramento, Calif.

FOR SALE — Overstock of Channel 40 and 46 standard coil strips, all letters. Will sacrifice $3.50 each on orders of 5 or more. Marion George, 1636 Market St., San Francisco, Calif.

SELL OR TRADE — BC-342-L, Serial 551 communications rcvr., $50; Hallicrafters type R44 spkr., $10; homebuilt 10 meter converter, $15. Swap for shop tools. R. Houghton, Littleton, Mass.

FOR SALE — Rek-O-Kut G-2 turntable, $65; Pickering 190 arm, $16; S-120M cart., $5; S-140S, $8.50; Audax VL-9 head, No. 16 arm, $25; UTC LS-55, $9.50. FOB, all like new. L-R Electronics, Box 572, Muscatine, Iowa.

FOR SALE — Latest model Webcor 210-1C tape recorder, 1 reel tape, perfect cond. $135 takes it. Spencer Dubov, 3100 Brighton 2nd St., Brooklyn 35, N. Y.

WANTED — Technical maintenance manual for AN/APN-4 loran indicator-rcvr. system, must be complete and in good cond. State price. Roy Carling, R. 1, Howard City, Mich.

FOR SALE — TV boosters: Regency model DB-410, channels 2 - 13 (cases cracked), $9.95; Astatic, channels 2 - 13, model BT, $12.50; two JFD, channel 4, model SW, $7.50; VEE-D-X, channel 4, model OB, $7.50. Marvin Sims, 3022 Euclid, Lawton, Okla.

SWAP — Open walnut phono cabinets, small quantity Alliance 78 rpm motors, VM 78 rpm automatic changer, for small communication receiver and/or TV test equip. and parts. John Graham, 7 Wawanda, Liberty, N. Y.

WANTED — 50 to 100 w. PA booster, dynamic hand or desk stand mikes; sound powered handsets, PM spkrs., wall or outdoor type; 2 cond. shielded mike cable. Electronic Service, 4918 Beech St., Hammond, Ind.

WANTED — Detector head and coil for army mine detector, SCR625C, old radio, and automobile books before 1930 for cash or have radio parts, hearing aid, hearing aid battery charger. John Haynes, Doe Run, Mo.

FOR SALE — Riders manuals 13 and 14, $15 each, good as new. Want wire recorder in A-1 cond. Geo. W. Howerton, 8 South Bedford Ave., Evanville 13, Ind.

FOR SALE — TV Boosters: Masco Sky Chief MB-2, $15; Regency DB-400 or DB-410, $10 each; Regency DB-520, $12; JFD Tuck-A-Way VB, channel 12, $7 postpaid. All like new with tubes. L. M. Baumgartner, 97 East Center St., Shavertown, Pa.

WANTED — Schematic or manual for National RCK rcvr.; measurements model 59 oscillator. Have for sale wire recorder, Web-Chi 180-1, leatherette carrying case, with mike and wire, l. n., $55. A. C. Livingstone, 12-01 Ellis Ave., Fair Lawn, N. J.

WANTED — FM tuner 88-108 mc., state make, model, price postpaid. J. Coffield, 1402 West 4th St., Brooklyn 4, N. Y.

FOR SALE — RCP model 701 sig. gen., RF-AF, 75 kc. to 150 mc. in seven bands with vernial scale with shielded leads, perfect operating cond., $15, plus shipping. Also magazines for 15 cents each. Harold Levinson, 61-17 81st St., Elmhurst, L. I., N. Y.

FOR SALE — Heath AT-1 transmitter $23; VFO, $18. Both in new cond. Michael Geller, Antenna Sect, c/o E.T., Patuxent River, Md.

FOR SALE — Precision P-120; Bliley Xtal. sig. gen.; Meissner analyst; Heath 5" scope; Supreme 565 push-button VTVM, 500 v. DC . Instruments in perfect cond., instruction and probes. Sacrifice price, $130. Dr. Peter Paul Nichols, 67-05 Fresh Pond Rd., Brooklyn 27, N. Y.

SELL OR TRADE — Meissner 78 rpm disc recorder and phono combination, good cond. Want binoculars, rifle, or $30 cash. Howard Radio Service, 727 East 10th St., Brooklyn 30, N. Y.

FOR SALE — Books: Essentials of Radio, Slurzberg-Osterheld; Elements of Radio Servicing, Marcus-Levy; Basic TV, Grob; TV Servicing, Heller - Schulman; TV Servicing, Mandl; Receiver Circuitry-Operation, Receiver Troubleshooting, Repair, Ghirardi. Best offer. Dennis Marote, 51 Sherman St., New Bedford, Mass.

SELL OR TRADE — Antique radio horn speaker; 1. n. Howard FM converter; several TV boosters, good cond. Want RCA or Precision sig. gen., for radio service, good late model. J. H. Wyatt, Route 5, Searcy, Ark.

WANTED — Monitone or self-powered Monitor, DB22 pre-selector. Will trade 8" "Dunlap" saw and ¼ hp. motor. Roland Slatkoff, 3834 Southern Cross Dr., Baltimore 7, Md.

POSITION WANTED — In radio and TV service shop. Have completed DeVry course and done bench work for 3 yrs. P. Ferrina, 4309 Kansas Ave. NW, Washington 11, D. C.

WANTED — Tracer electronic volt and ohm meter in good cond. W. Slon, 554 Euclid Ave., Brooklyn 8, N. Y.

FOR SALE — Like new portable Weston tube checker, model 777, $20. Paul Davis, 141 - 21 78th Road, Flushing 67, N. Y.

FOR SALE — SCR522 receiver and transmitter, rack and panel, four crystals, meters, 2 power supplies, push-to-talk mike, 6 element beam. Try it before you buy. $95. S. Casey, 169 Hall Ave., Perth Amboy, N. J.

FOR SALE — 7" Motorola table model, TS-4J, in perf. cond., wood cabinet, $15.95. Will ship anywhere. Jones Radio, 1115 Rambler Ave., Pottstown, Pa.

FOR SALE — NRI sig. tracer, model 33, $40; assorted radio parts and 14" TV-radio comb., $15. Want 25 Colt revolver and amplifier, around 30 w. Ernest Beard, 6407 South Wolcott St., Chicago 36, Ill.

TRADE — Two 7PJ4 picture tubes; also 10BP4 and 12LP4; Superior multimeter. Want tube checker, tubes, or what have you? George Lawton, 30 Thames St., Newport, R. I.

WANTED — Receiver, Super Pro, HRO, RCA AR88, 175. State price and cond. Also need 2500 - 3000 v. Xformer at 750 Ma. State size. J. J. Santomas, 14 Railroad Ave., Hammonton, N. J.

SELL OR TRADE — Meissner deluxe sig. shifter with 80 and 40 coils, all self-contained. Want SW rcvr. Ted Fisher, 1585 "H" St. NE, Washington 2, D. C.

WANTED — Type 0-7 and two 0-13 UTC transformers. Have RCA 45 rpm record player, Heath VTVM, TV tubes and other rec. Xmitter parts. Chips Radio, R 9, Box 368, Tuscon, Ariz.

SELL OR SWAP — TV sweep gen., McMurdo-Silver, model 911, internal, 1 mc. and 5 mc. Xtal markers, $30 cash and $30 worth of standard brand, boxed, unused tubes of my choice, or $60 cash. C. Elgasser, 1920 Fern, San Diego 2, Calif.

SELL OR SWAP — Dumont 5" scope, $75; E-D VTVM, $35; BC-221, $85; Precision E-400, $115; EV-10S VTVM, with probe, $70; Eimac 100TH's; for GE ST2A scope, condenser checker by Sprague, and Simpson 269 with case. John Pellock, 236 Maderia, Coral Gables, Fla.

SWAP — 16 w. CW 40 meter mobile Xmitter (home-made) with 6 v. input, 450 output power supply, for S38C/S40 or equivalent rcvr., or 75 w. minn. transmitter for home station, or what have you. J. C. Stephens, 3200 Kennilworth Ave., Bladensburg, Md.

SELL OR TRADE — Basic wire recording mechanism, complete with special oscillator coil, schematic and parts list, Webster model 79. Earl Zugar, 23 Foreman Ave., Uniontown, Pa.

FOR SALE — 10" TV set, $25; Millen 90800 exciter with 80 m. and 40 m. coils, $14; Heathkit AR1 rcvr. with cabinet, $12. David A. Wesley, RFD 4, Ridgefield, Conn.

FOR SALE — Tel-A-Ray PTB1 TV booster, No. 10968. Buy or trade for 2-way radio to use in car. Must be complete and OK. Ellison Radio Service, Centertown, Ky.

SWAP OR SELL — Abbot Instruments TR4, good cond., two meter transmitter and rcvr. with AC power supply for small portable 75 meter ECO controlled transmitter-receiver. Prefer with AC power supply or ?? James Cunningham, 2274 Hickory Rd., Chamblee, Ga.

SELL OR SWAP — Like new 2C51 and 5670 tubes for square-wave generator described in Nov. issue of Capacitor. Also have many crystals, 1N21B, etc. Florence Wong, 1756 Manhattan Beach Blvd., Manhattan Beach, Calif.

SWAP OR SELL — PE-103 w/o base; Electric Instructograph with 10 tapes, 1. n.; Riders radio manuals 1 to 5; RCA AM-FM sig. gen., model 150; Turner & Regency TV booster; aircraft surplus 274-N equip. Emmet D. Cox, 2912 Madison Ave., Evansville 14, Ind.

SELL OR SWAP — GE old band 42-50 mc. FM converter, exc. cond. Would like a good late type UHF converter or best offer. Joseph F. Dineen, 9 Winter Terr., Westwood, Mass.

FOR SALE — Two picture tubes, 10BP4, guaranteed price reasonable, pickup only. John B. Rosenbery, 147 North Cuyler Ave., Oakpark, Ill.

FOR SALE — Unused Mallory Vibrapack, 6 v., model VP554, and Eicor dynamotor, 12 v., 440 v. DC, 200 MA. Both for $12 money order. Eugene Cheney, Nora Springs, Iowa.

FOR SALE — S-40 rcvr., aligned, good cond., $60; SCR-274 aircraft radio, complete; 2 Lear 200-400, SW, BC band portable receivers, one good, one needs output Xformer. W. D. Erickson, 12 Hampton Court, Spartanburg, S. C.

SWAP — English bicycle (standard), fully equipped, originally $90, for Heathkit scope 0-10 kit wired. Will sell Pentron 9TC3 and Riders vol. 14. H. Lejuez, 20-31 18th St., Astoria, Long Island City, N. Y.

SWAP — Zenith AC-DC portable model 6G-061-ML, 100 assorted radio tubes, for U. S. or foreign stamps. Joseph Palmer, 786 East 94th St., Brooklyn 36, N. Y.

FOR SALE — Hallicrafter S-29 3-way, 4-band portable receiver, good except BFO doesn't work, $10; Gilbert U-239 Geiger counter, 1. n., $8. You pay postage. David Hodges, 7 Sycamore St., Bronxville, N. Y.

SELL OR TRADE — Parts for RCA MI-12875 wire recorder, including good wire cartridge. Also Presto K-8 disc recorder and other audio equipment. Want Daven 250 & 600 ohm Tee pads and Hi-voltage chokes. Roland Jordan, Jr., 1501 Broad St., Selma, Ala.

WANTED — Bandmaster deluxe w/power supply and VFO for same. Trade or sell, Millen exciter, XE10 Sonar FM exciter, 600 v. power supply, 1200 v. power supply, all size meters. Joseph Hellman, 65-33 78th St., Middle Village 79, N. Y.

FOR SALE — Hickok: sweep gen., model 288X, $85, tube tester, model 532, $65, tube tester, model 534, $100. Elmer Allen, Jr., 1708 Castle Garden Road, Vestal, N. Y.

FOR SALE — 112 Aerovox L72498 oil-filled oil-impregnated condensers: 5 MFD 50 v. RMS 400 cy., 2 MFD 80 v. RMS 400 cy., 5 MFD 400 v. DC. Herr Electric Co., 410 West Conway St., Baltimore 30, Md.

FOR SALE — Sylvania model 501 marker generator with 4.5 mc. crystal; Heathkit model 0-8 scope with voltage calibrator; Raytheon tube caddy; several used TV service books. Robert Fellows, Caledonia, N. Y.

WANTED — Meissner TV rcvr., model 10-1153; Sprague Tel-ohmike TO3; technical manual for BC-654A. W. E. Schwenzer, 3619 Peach St., Erie, Pa.

FOR SALE — Western lab meters; KW transmitter; teletype, models 14 and 19; West. Elec. F6C; 2 Hughes Mitchell VFO units; Dumont 3" oscillograph. Mrs. Shepard, 460 Olivia Pl., La Canada, Calif.

SWAP — Stamp collection 13,000 varieties, value $100 for Hi-Fi or photographic equip. W. A. Harris, 1 Bedford St., Lexington 73, Mass.

WANTED — National 100X rcvr., with spkr., in good cond., or National 173 rcvr. Will pay shipping. Larry Wood, c/o Instrument Lab. Service, 10701 Briggs Rd., Cleveland, Ohio.

WANTED — Operation, maintenance, and alignment instructions and associated schematics; and/or conversion info. for the U. S. Signal Corps wireless sets, No. 19, Mark II. State cond., price in first letter, or what do you need? Hammond Electronic Service, 2908 Venice Rd., Sandusky, Ohio.

FOR SALE — National rcvr., model NC-125 with matching spkr., in exc. cond., $100 plus postage, insurance. Mel Sutkus, ET2, T Div., USS Albany, CA-123, c/o FPO, New York, N. Y.

WANTED — New or in new cond., Hickok model 156A Traceometer, complete set UMS auto, home and TV manuals. RCA crystal calibrators. Paul Capito, 637 West 21st St., Erie, Pa.

WANTED — Tubes: special purpose, receiving tubes bought for cash. Jack Garretson, 325 Avenue P, Brooklyn 4, N. Y.

TRADE — NRI radio-TV servicing course, 65 lessons, less kits, for tube tester, typewriter, Hallicrafter rcvr. John L. Carlson, 29 Holmes St., East Hartford, Conn.

SELL OR TRADE — Simpson 260; Heathkit Handitester M-1; Moss model 247 tube tester. Want battery eliminator, tape recorder or mechanism only. All units FOB. Arnold Margolis, 120 - 16 234th St., Cambria Heights 11, N. Y.

SELL OR TRADE — Millen 90810, Millen HV power supply, Collins BC modulator, separate HV power supply; spare tubes, coils 2-6-10-20, all in par metal deluxe rack, also VHF 152-A. Want NC-183-D. R. Forester, RD 2, Belle Vernon, Pa.

TRADE, SELL OR LEASE — Complete radio-TV sales and service shop with attached three-bedroom home. Total valuation with inventory $15,000. Only shop in town of 4,000 population, in Northern Calif. Same location over 14 years. Ed. M. Cripps, 1110 Florence Ave., Dunsmuir, Calif.

FOR SALE — Color TV tube, RCA 156P22 with necessary deflection yoke and high voltage transformer, never used, complete, $195. R. Feerick, 3095 Bruckner Blvd., Bronx 61, N. Y.

FOR SALE — Simpson: model 480 Genescope ,model 260 VOM, model 335 tube tester and model T0-3 Sprague Tel-Ohmike condenser and resistor checker. E. Nadosy, 9701 Francisco Ave., Evergreen Park., Chicago 42, Ill.

SWAP — Army freq. meter, BC-221-T, Dumont scope 274, Eico scope 425, for 35 mm. camera, slide projector, range finder, exposure meter. Peter Mangeracine, 1196 Hancock St., Brooklyn 21, N. Y.

FOR SALE — Recording tape, used, plastic base, 1200 feet on a 7" reel. 6 reels $7, 12 reels $13. Send stamped envelope for sample of tape. R. Lackner, 2029 Bradley, Chicago 18, Ill.

WANTED — RCA WO-57B 3" scope, Do All 740 gen., Sams Photofacts, vols. 15 up. State price and cond. Walter E. Niemiec, 227 Fairway Dr., New Hartford, N. Y.

SELL OR TRADE — Millen 90651 grid dip meter, with coils to cover 300 kc. to 300 mc. Need BC-348P or similar rcvr. H. F. DeGarmo, Early, Iowa.

TRADE — Echophone commercial receiver with built-in speaker, l. n., for metal locator in as good shape. Also have 18 tube Midwest all-band rcvr. with 12" speaker. S. P. Osborn, 519 East Federal, Drumright, Okla.

FOR SALE — West. Elec.: Hi-Fi dynamic headset $30, 630-A dynamic mike complete with swivel, plug and baffle, adapter for quick interchange of 630 and 633 mikes. John Cermak, 542 Woodside, Hinsdale, Ill.

FOR SALE — Antique radios, or will trade for what you have. Better Radio Service, 1227 37th Ave., San Francisco 22, Calif.

WANTED — Sweep gen., prefer one with internal marker. A. Adams, 719 Park Ave., Williamsport, Pa.

FOR SALE — Riders radio vols. 1 thru 20, in exc. cond., $100, or consider swap for receiving tubes or modern test equip. Layton Ledford, 503 West Linn Street, Marshalltown, Iowa.

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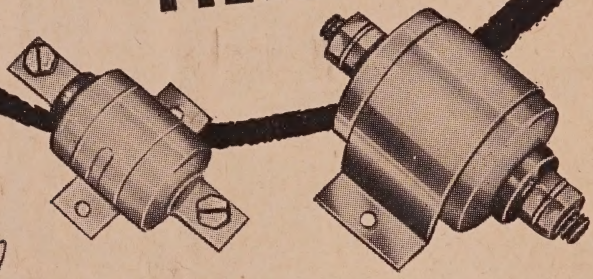

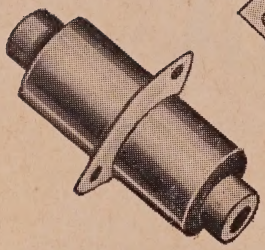

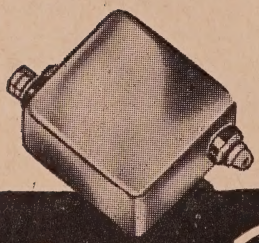

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